

WHAT IS CLAIMED IS:

1. Apparatus for detecting particles on a surface of a semiconductor wafer, said surface having repetitive patterns, the apparatus comprising:

- a. a laser for illuminating an area on said surface with a beam of polarized light,
- b. a first camera,
- c. a first imaging lens for collecting light scattered from said area, said first imaging lens forming a Fourier diffraction pattern of light scattered from said area illuminated,
- d. a Fourier mask for blocking light in said Fourier diffraction pattern where the intensity is above a predetermined level indicative of background information and leaving in areas where the intensity is below said predetermined level indicative of particle information, the Fourier mask including a spatial light modulator (SLM) which is optically addressable and a polarization discriminator,
- e. a second camera,
- f. a second imaging lens for imaging the Fourier diffraction pattern formed by the first imaging lens into the second camera, said second camera converting the image of the Fourier diffraction patterns into a stream of digital electrical signals,
- g. a processor for processing the stream of digital electrical signals formed by the second camera,
- h. a liquid crystal display (LCD) for converting the output of the processor into a video image, and
- i. a third imaging lens for imaging the video image of the LCD onto the SLM,

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j. said first camera recording the image of the area imaged by said first imaging lens using scattered light not blocked by said Fourier mask.

2. The apparatus of claim 1, wherein said first camera is a high sensitivity camera.

3. The apparatus of claim 2, wherein said polarization discriminator is a polarizing beamsplitter,

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4. The apparatus of claim 3, wherein said laser produces a plane polarized beam of light.

5. The apparatus of claim 4, wherein said SLM includes a 100% reflective mirror.

6. The apparatus of claim 5, wherein said 100% reflective mirror is a dielectric mirror.

7. The apparatus of claim 6, wherein said SLM further includes a liquid crystal layer.

8. The apparatus of claim 7, wherein said SLM further includes a photoconductor layer.

9. The apparatus of claim 8, wherein said first camera is a CCD camera.

10. The apparatus of claim 8, wherein said second camera is a CCD camera.

11. A method for detecting particles on a surface of a semiconductor wafer, said surface having repetitive patterns, the method comprising:

a. illuminating an area on said surface with a beam of polarized light,

b. collecting light scattered from said area using a first imaging lens, said first imaging lens forming a Fourier diffraction pattern of said light collected,

c. removing from said Fourier diffraction pattern light whose intensity is above a predetermined level indicative of background information and leaving in areas whose intensity is below said threshold level indicative of particle information using a spatial light

modulator which is electrically addressable and a polarization discriminator in the form of a crossed polarizer and

d. recording an image of the area imaged said imaging lens using scattered light not removed by said Fourier mask.

12. Apparatus for detecting particles on a surface of a semiconductor wafer, said surface having repetitive patterns, the apparatus comprising:

- a. a laser for illuminating an area on said surface with a beam of polarized light,
- b. a first camera,
- c. a first imaging lens for collecting light scattered from said area, said first imaging lens forming a Fourier diffraction pattern of light scattered from said area illuminated,
- d. a Fourier mask for blocking light in said Fourier diffraction pattern where the intensity is above a predetermined level indicative of background information and leaving in areas where the intensity is below said predetermined level indicative of particle information, the Fourier mask including a spatial light modulator (SLM) which is optically addressable and a polarization discriminator,
- e. a second camera,
- f. a imaging lens for imaging the Fourier diffraction pattern formed by the first imaging lens into the second camera, said second camera converting the image into a stream of digital electrical signals,
- g. a processor for processing the stream of digital electrical signals formed by the second camera, and
- h. an SLM controller for applying the output of the processor into the SLM,

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i. said first camera recording an image of the area illuminated by said first imaging lens and not blocked by said Fourier mask.

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13. Apparatus for detecting particles on a surface of a semiconductor wafer, said surface having repetitive patterns, the apparatus comprising:

- a. a laser for illuminating an area on said surface with a beam of plane polarized light,
- b. a first camera,
- c. a first imaging lens for collecting light scattered from the area, said first lens forming in its back focal plane a Fourier transformation of the image in the Fourier plane of the first lens,
- d. a second camera for receiving an image of the Fourier transformation and producing a stream of digitally electrical signals of the image received,
- e. a processor for processing the electrical image produced by the second camera,
- f. A Fourier mask disposed in front of the first camera, the Fourier mask including an electrically addressable SLM and a crossed polarizer, and
- g. a controller for receiving information from the processor and applying voltage signals to the SLM in response to such information received from the processor,
- h. said first camera receiving an image of the area illuminated by the first imaging lens and not blocked by the Fourier mask.

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14. The apparatus of claim 17 and wherein said SLM is arranged for operation in a transmission mode.

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